

CLAIMS

We claim:

1. A method for the deposition of a thin film material upon a
5 substrate comprising the steps of:
 - providing a confinement cup;
 - providing a substrate in the confinement cup;
 - providing a vacuum source for evacuating the confinement cup
to sub-atmospheric pressure;
 - 10 providing a dense hot filament which is heated to about 1500 C
or higher;
 - providing at least one first gas inlet adjacent the dense filament
for introducing at least one gas into the evacuated confinement cup through
the inlet; and
 - 15 providing at least one second gas inlet in a spaced apart
relationship to the dense filament and introducing at least one gas into the
evacuated confinement cup through the inlet.
2. The method of claim 1, including the further step of heating the
20 substrate to a temperature between room temperature and about 500 C or
higher to enhance the surface mobility of atoms during film growth.
3. The method of claim 1, including the further step of evacuating
the confinement cup to a sub-atmospheric pressure by evacuating the
25 confinement cup to a pressure of about 10^{-5} Torr or less.
4. The method of claim 1, wherein the dense hot filament
comprises a densely pack filament coil or other dense filament structure.
- 30 5. The method of claim 1, wherein the at least one gas introduced
into the evacuated confinement cup includes at least one of the following: H₂,

silicon hydride (SiH_4 , Si_2H_6 , Si_3H_8 , $\text{Si}_x\text{H}_{(2x+2)}$), silicon fluorid , germanium hydride, germanium fluoride, carbon hydride, carbon fluoride.

6. The method of claim 1, further including providing at least on
5 electrode in the confinement cup to strike and maintain a plasma for the film deposition.

7. The method of claim 6, wherein the electrode delivers power at the frequency of 0 (DC) to 150 MHz (VHF) including 13.56 MHz (RF).

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8. The method of claim 6, wherein the plasma is stricken during the interface treatment.

9. The method of claim 6, wherein the plasma is stricken for
15 simultaneous plasma and hot-filament deposition.

10. The method of claim 1, in which the thin film material is deposited at a rate substantially higher than that of PECVD.

20 11. An apparatus for the deposition of thin film material upon a substrate comprising:

a confinement cup;

a vacuum source for evacuating the confinement cup to sub-atmospheric pressure;

25 a dense hot filament capable of being heated to 1500 C or higher;

at least one gas inlet adjacent the dense filament for introducing at least one gas into the evacuated confinement cup through the inlet; and

30 at least one gas inlet spaced apart from the dense filament for introducing at least one gas into the evacuated confinement cup through the inlet.

12. The apparatus of claim 11, including a means for heating the substrate to a temperature between room temperature and 500 C or higher to enhance the surface mobility of atoms during film growth.

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13. The apparatus of claim 11, wherein the confinement cup is capable of being evacuated to a pressure of about 10^{-5} Torr or less.

14. The apparatus of claim 11, wherein the dense hot filament
10 comprises a densely pack filament coil or other dense filament structure.

15. The apparatus of claim 11, wherein the at least one gas introduced into the evacuated confinement cup includes at least one of the following: H_2 , silicon hydride (SiH_4 , Si_2H_6 , Si_3H_8 and $Si_xH_{(2x+2)}$), silicon
15 fluoride, germanium hydride, germanium fluoride, carbon hydride, and carbon fluoride.

16. The apparatus of claim 11, further including at least one electrode in the confinement cup to strike and maintain a plasma for the film
20 deposition.

17. The apparatus of claim 16, wherein the electrode delivers power at the frequency of 0 (DC) to 150 MHz (VHF) including 13.56 MHz (RF).
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18. The apparatus of claim 16, wherein the plasma is stricken during the interface treatment.

19. The apparatus of claim 16, wherein the plasma is stricken for
30 simultaneous plasma and hot-filament deposition.

20. A thin film material deposited on a substrate using the method of claim 1.

21. The material in claim 20 used as an active layer in a photovoltaic device.

22. The material in claim 20 used as an active layer in a thin film transistor.

23. The material in claim 20 used as an active layer in an ac color plasma display.

24. The material in claim 20 used as a hard coating for tools.